VA State Cemetery
Sierra Vista, Arizona

WATER USE ANALYSIS

Prepared for:

Carter-Burgess
Phoenix, Arizona

(Retyped 7/1/00 from a facsimile copy received 5/8/00. The report is Appendix "E" of the Environmental Assessment prepared by Western Technologies on June 15, 2000)

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I. Methodology:

A meeting between Xeris Group and Carter Burgess was held to coordinate the gathering of facts, site data and mutually agreeable assumptions. This meeting also includes a BAT (Best Available Technology) brainstorming session. The Carter-Burgess people compiled site data, plant pallets and crop factors for the proposed plant pallet. The Xeris Group people gathered weather data from AZMET (Arizona Meteorological network) and researched additional BAT data.

The Xeris Group people used the compiled data to develop a water use scenario for the 30-year build-out period. Data on Crop factors, areas and plant pallets were used along with weather data and assumptions about the irrigation system and facilities to calculate annual site water use. Explanations and justifications were included where necessary to add clarity to the report.

II. Given Data and Assumptions

A. From Carter-Burgess:

Program Factors	Quantities	Sq. Ft./Unit	Acres (30-Year)	Water Required	Comments
Annual Burial Rate	519				
35% full-casket burial	181.65	24	3.00		
65% Cremation	337.35	16	3.72		
Number of Personnel:					
Admin Workers	2.26			150 gpd	City Std.
Field Workers	4.28			150 gpd	City Std.
Cemetery Director	1			150 gpd	City Std.
Total:	7.54				
Anticipated Visitors Per Internment	15			50 gpd	City Std.
Maint. Operations	3			150 gpd	City Std.
Buffer Zones		1,200,253	27.55	None	200' east, 100' others
Manicured Area @ Roads and Graves		53,458	1.22		Assembly area Entrance, Plantings @ Buildings

Area to be disturbed and revegetated					
Undisturbed Areas				None	
Administration Bldg.	1	1,626			
Maintenance Bldg.	1	1,551			
Maintenance Yard	1				
Committal Shelters	1	1,065			
Vehicle & Equipment Storage Building	1	1,264			
Road Acreage		245,000	5.62		
Crop Factors for Grave Sites					
Bermuda	0.85	March through October			
Native Grasses Blue/Black Gramma Sideoats Gramma Curly Mesquite	0.65	March through October			

Source of Crop-factor data: Dr. David Copek, U of A Plant Science Dept.

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B. From Xeris Group:

Average ET (Evapotranspiration) and Rainfall for Safford, Arizona, from 1987 through 1995:

Month	ET	Rainfall
January	2.6	0.88
February	3.54	0.94
March	5.91	0.65
April	8.41	0.23
May	10.13	0.3
June	10.84	0.15
July	9.47	0.93
August	7.46	2.45
September	6.7	0.76
October	5.48	0.57
November	3.55	0.49
December	2.33	1.3
Annual	76.4	9.6

Source of data: AZMET

Note:

1. There is no AZVET weather station in or near Sierra Vista or Fort Huachuca. Of all the weather station sites available from AZMET, Safford had weather most like Sierra Vista. Actual irrigation programming will not be done using Safford weather data. Actual irrigation programming will be done based on on-site weather-gathering equipment that is interactive with the irrigation control system.
2. AZMET uses a standard Campbell Scientific weather station to measure weather data. ET is calculated using a modified Penman equation Reference ET (Eto) for high-cut Tall Fescue.

C. Assumptions:

This analysis is based on the following assumptions:

1. Bermuda grass, cut high, will be used on grave sites.
2. Native grasses, cut high, will be used on all other manicured areas around graves and along roads.
3. Buffer areas will not be watered after revegitation period.

4. Temporary aboveground irrigation will be used for revegitation only and removed once plants are established (type of system to be determined during design).
5. Undisturbed areas will be watered with naturally-occurring rainfall only.
6. Both grave sites and other manicured areas will be watered from March through October only.
7. All grasses will be considered dormant from November through February.
8. BAT procedures and technologies will be used extensively to keep water consumption as low as possible.
9. The sprinkler system will achieve a DU (Distribution Uniformity) of at least 65%.
10. The weather in Sierra Vista is not more severe than weather in Safford, Arizona.

III. Technologies and Procedures used to Obtain Stated Water Use:

A. Technologies:

1. Valve-in-head sprinklers will be used to allow individual heads to be shut down when a grave is opened, a burial is in progress or an area is under repair. This will allow a completed system and then water the areas incrementally as they are developed.
2. Sprinklers, and sprinkler spacing will be selected with the highest possible DU.
3. Sprinkler zoning will be done by plant type, area-use type and exposure.
4. A control system will be used that is ET-driven from on-site weather data. The system (Calsense ET1 or equal) will have a flow meter and master valve that will allow zones to automatically shut down if a head blows o pipe bursts. It will also allow the master valve to automatically adjust its watering program each night based on the local ET measured that day.
5. Waterless urinals will be used in the Men's restrooms.
6. Composting waterless toilets will be used in all restrooms.
7. Low-water-use fixtures will be used where possible.

B. Procedures:
1. Only grave sites and manicured areas along roads and around the administration building will be irrigated.
2. There will be no irrigation from November through February.
3. All maintenance personnel will b encouraged to take advantage of classes available through the U of A extension office on Water Management.
4. Training on how to set up and use the irrigation control system will be provided by the equipment manufacturer.

IV. Water Use Analysis:

A. Irrigation Water Use:

Irrigation Calculations 10-year Build-out , stressed turf:

	Areas in Acres	Acres in Sq. Ft.	Reference ET for Period in Inches	Average Rainfall for Period in Inches	Crop Factor	Target DU	Water Required in Acre Inches	Water Required in Acre/Feet	Acre/Feet Per Acre	Thousands of Gallons Required
Bermuda Areas	2.24	97,572	64.4	6.04	0.5	0.7	93.37	7.78	3.47	2,635
Manicured native										
grass areas	1.08	47,045	64.4	6.04	0.3	0.7	27.01	2.25	2.08	733
All Irrigated										
Acres (Totals)	3.32	144,617					120.39	10.03		3,368

Irrigation Calculations 30-Year Build-out, stressed turf:

	Areas in Acres	Acres in Sq. Ft.	Reference ET for Period in Inches	Average Rainfall for Period in Inches	Crop Factor	Target DU	Water Required in Acre Inches	Water Required in Acre/Feet	Acre/Feet Per Acre	Thousands of Gallons Required
Bermuda Areas	6.72	292,715	64.4	6.04	0.5	0.7	280.12	23.34	3.47	7,606
Manicured native										
grass areas	1.22	53,143	64.4	6.04	0.3	0.7	30.51	2.54	2.08	828
All Irrigated										
Acres (Totals)	7.94	345,849					310.84	25.88		8,434

B. Non-irrigation Water Use:

Non-Irrigation Water-use Calculations:

	Quantity	Days	Intern-ments	Gallons per person per day	Gallons per person per internment	Calculated Water Use in Thousands of Gallons
Admin Workers	2.26	260.71		150		88
Field Workers	4.28	260.71		150		167
Cem. Director	1	260.71		150		39
Visitors for Internment	15		519		50	389
Visitors for maintenance	3	365.00		150		164
All non-irrigation uses (Total)						348

V. Summary:

30 years, stressed turf:		10 years, stressed turf:	
For Irrigation	8,434	For Irrigation	3,269
Other Uses	848	Other Uses	848
Annual Site Water Requirement in thousands of gallons	9,283	Annual Site Water Requirement in Thousands of Gallons	4,117
Annual Site Water Requirement in Acre Feet	28.49	Annual Site Water Requirement in Acre Feet	12.64

The site has a peak annual water requirement of 9,283,000 gallons of water. This equals 28.49 acre-feet per year or 25, 432 gallons per day. These figures are calculated based on the data and assumptions shown in this report. Calculations were also done for a 10-year build-out. Actual water use will very according to weather and actual management practices.